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WHAT IS KNOWN ABOUT DISEASE POTENTIAL OF WIND-THROWN TIMBER

A SUMMARY REPORT

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A SUMMARY REPORT ON WHAT IS KNOWN ABOUT DISEASE POTENTIAL OF WIND-THROWN TIMBER

DETERIORATION IN BRIEF

1. Pathological deterioration starts almost immediately following windthrow and will continue at a variable rate from one tree or locale to another depending upon tree species, size, and on the environment.

2. Generally speaking, the deterioration rate of wind-thrown timber from decay in decreasing order of species resistance is as follows:

(1) Western hemlock
(2) True firs
(3) Spruce; second-growth Douglas-fir
(4) Pines
(5) Old-growth Douglas-fir; western larch
(6) Western redcedar

3. Indications are that the least durable tree species in most localities where the windstorm of October 12, 1962 occurred will have little economic salvable volume (from pathological standpoint) three to five years after windthrow, but that some salvage will remain feasible in the more durable species for ten to twenty years or more.

4. The high-grade, high-value lumber is manufactured from the outer core of logs. This is the area first to be invaded by decay. Therefore, when the sapwood and outer heartwood is decayed, the log has lost a high portion of its value even though less than half its volume is destroyed.

5. Results presented in this and other reports can serve only as rough guides to probable deterioration and care should be used in direct application. In application of results from one study to particular instances, the forester must use good judgment and past experience.

6. Irrespective of the time that some salvable volume will remain, it is advisable to start salvage as soon as possible in blowdown regardless of tree species and environmental conditions if deterioration losses are to be minimized.

INTRODUCTION

On October 12, 1962 a violent windstorm occurred in parts of Washington and Oregon. Damage to timber stands was extensive, with volume of blowdown amounting to several billion board feet. The gusty nature of the winds caused much of the damage to occur in scattered patches and scattered trees rather than in a continuous swath, although in some areas extensive blowdown resulted.

Most damage occurred west of the Cascade Crest and extended from the California border to extreme northwestern Washington. However, some blowdown occurred on the east side of the Cascades, especially on and in vicinity of the Winema, Deschutes, and Fremont National Forests.

THE PROBLEM

In general, the urgency to salvage blowdown because of the current insect and fire hazards will automatically take care of the early pathological problems. After two or three years, the fire hazard and insect buildup potential will more or less disappear. The problem then becomes largely a pathological one. Therefore, from the pathological standpoint, our concern is mostly with the long-term effects that will result from: (1) Deterioration of blowdown in areas that cannot be immediately salvaged and (2) the disease potential that will result from injury that has or will occur to the residual stand.

The amount of pathological deterioration in wind-thrown timber that can be tolerated and the logs still be salvaged depends on size of timber, value of species, accessibility, volume available in an area, utilization standards, and several other factors. Probably, in most instances, salvage is uneconomical when 50 percent of the gross volume has been destroyed.

OBJECTIVE

The purpose of this report is to summarize what is known about pathological deterioration and decay of wind-thrown and wind-damaged timber so that: (1) Losses can be salvaged while they remain in a useable condition and without appreciable loss of volume and grade; (2) to give the forest manager a better understanding of the long-term losses to aid him in determining the time available to shift emphasis, to build roads, and to schedule production in regard to blowdown that cannot be immediately salvaged.

In this report, deterioration will be restricted to losses caused by disease organisms. At the same time, it is realized that considerable deterioration can result from insect attacks by ambrosia beetles, wood bores, and others.

Damage to timber stands from windstorm is of three major types:

(1) Uprooted trees and leaners.

(2) Roots more or less intact but with a portion of the live crown broken out or the tree broken off somewhere below the live crown.

(3) Injury to the merchantable and nonmerchantable stand from falling trees or portions of trees.

Therefore, we have two broad damage categories with which we are concerned: (1) Dead trees on the ground because of uprooting or breakage; (2) living trees that are leaning, those that have part of the crown broken out by the wind, and those that have been injured by falling trees.

DISEASE POTENTIAL

General

Except for damage by insects, practically all deterioration of wood is caused by fungi. The wood-attacking fungi fall into two broad groups: (1) Sap-stain and mold fungi that produce disfiguring discolorations but have little effect on strength properties; (2) a wide variety of decay fungi, which attack the sapwood or heartwood or both and eventually weaken and destroy the wood.

In addition to a suitable substratum, moisture, temperature, oxygen, and light are requirements needed for growth of wood-destroying fungi. Of the factors affecting fungal growth, moisture-temperature relationships are the most important. None of the wood-attacking fungi can grow in wood with a moisture content below 20 percent. On the other hand, completely waterlogged wood lacks enough oxygen for growth. Temperatures of 70° to 85° F. provide optimum conditions for growth of fungi. Growth is very slow below 50° F. and over 100° F.

The pattern of fungal succession in down timber usually starts with blue stain and mold. Sap-rotting fungi follow. Most sap rots are restricted to the sapwood but some such as Fomes pinicola may continue development into the heartwood. Heart rot organisms are last in the succession and complete the deterioration of the wood.

Blue stain

Blue stain may start on the exposed portion of trees a few months after blowdown. However, severe staining usually follows insect attack.

Blue stained wood can be used successfully where the undesirable discoloration will be of little or no consequence. Strength of the wood is not affected appreciably but durability may be affected slightly. It has been shown that stained wood may decay more rapidly than unstained wood.

Decay in living trees

Windthrown trees frequently break off branches or tops, or knock off large patches of bark from trunks of their neighbors causing open wounds. Decay and other diseases in these damaged trees will

be a major loss that will continue over a long period of time. These indirect losses cannot be accurately measured and we will never know their full impact.

Losses to excessively damaged merchantable trees can be held within reasonable limits by proper marking and removal of such trees during salvage of the down timber in the area or during a later follow-up operation. Little can currently be done to alleviate losses that will result from injury to the growing stock from falling trees. However, careful planning and management in future years may reduce losses in these young age classes.

Decay in dead trees

Exact guidelines for rate of decay deterioration in down timber cannot be given because of the extreme variation that occurs by species, size class and environmental factors.

Desirability of immediate salvage of wind-thrown timber to avoid losses in volume and grade was brought out in a study by Weyerhaeuser Company investigators in southwestern Washington. Within three years decays had affected up to 40 percent of the volume of western hemlock, Pacific silver fir, and second-growth Douglas-fir. Old-growth Douglas-fir showed lower losses of about 14 percent.

In 1953, Childs and Clark gave results of decay studies made in wind-thrown Douglas-fir, Sitka spruce, western hemlock, and silver fir in western Washington and northwestern Oregon. Indications were that hemlock and silver fir decay rapidly under all environmental conditions to which they are subjected in this area, that Sitka spruce decays fairly rapidly, and that Douglas-fir heartwood is quite durable although the sapwood decays fairly rapidly.

Studies made in the Olympic Blowdown of 1921 show that wind-thrown trees in the coastal spruce-hemlock and old-growth Douglas-fir types must be salvaged in one or two years to avoid any appreciable decay loss. Nevertheless, Douglas-fir trees over about 30 inches in diameter had considerable sound volume after 15 years. In Sitka spruce, western hemlock, and silver fir, sound volume had been reduced by 60 percent or more at the end of five years. After 15 years the decay loss in western redcedar did not exceed the original sapwood volume.

Canadian workers found important differences between deterioration rates in white spruce and subalpine fir after wind-thrown in the Prince George Region (central-interior) of British Columbia. Losses were equivalent for both species at end of three years. However, subsequent advance of decay was much more rapid in spruce than in subalpine fir. They concluded that salvage operations would have

to be completed by the sixth year in white spruce, but apparently could continue for a longer period in subalpine fir.

Below is a list of conditions and factors to consider in decay of down timber:

1. Rate of decay is affected by durability of species, but sapwood of all species is about equally nondurable. The major difference in decay rate among conifers occurs after decay has reached the heartwood.

2. In all species, decay is usually negligible during the first year following windthrow, but is well started in the sapwood by end of second year. Sapwood zone is generally destroyed three years after blowdown.

3. Decay is faster in warm localities than in cool ones. Where winter temperatures are mild enough to permit fungal growth to continue during most of the year, decay will be rapid.

4. Decay is most rapid when temperature, moisture, oxygen, and light are present in ideal quantities; it is retarded, or even stopped, by excess or deficiency of any one of these.

5. Decay may be considerably retarded by excessive wetness of wood in trees lying in close contact with the ground and densely shaded by brush in rainy localities. Conversely, accelerated decay can be expected in exposed trees on less wet sites, especially if in close contact with ground.

6. Insects may provide entry courts for decay-causing fungi and therefore hasten deterioration rate. They may also carry spores of decay-causing fungi into the trees. Bark beetle attacks will increase blue stain and their galleries may improve aeriation of wet wood.

7. In most instances, loss will be largest in trees of small diameter and for a given time since death, percentage of decay will decrease with increasing size of tree.

8. With some exceptions, decay of wind-thrown timber in this region appears to be more rapid on the better sites.

9. Caution should be used in comparing deterioration of wind-thrown trees with beetle-killed and fire-killed timber.

10. There is no important disease that will build up to epidemic proportions in wind-thrown trees and then attack green timber.

Other disease potential and defects

Sunscald and shock from sudden exposure around heavy blowdown will result in some losses to the residual stand.

Blowdown in dwarfmistletoe infected areas may cause spread and intensification of the parasite. Any dwarfmistletoe infected residual overstory trees should be removed before blowdown areas are regenerated or to protect the existing young growth from increased infection.

Radial cracks and checks that may occur in down timber as the tree dries out is another defect of concern but only when trees are salvaged for lumber. Checking is usually absent on moist sites with bark intact, even a number of years after blowdown.

REFERENCES

Forest managers are encouraged to make use of the references given below. Caution should be used in direct application of results in specific areas to other areas because of inter-species and inter-regional differences in rate of deterioration.

References on injury and subsequent deterioration following logging, thinning, and pruning are given to serve as a guide on what may be expected from living trees that were wind-damaged.

Aho, P. E. 1960. Heart-rot hazard is low in Abies amabilis reproduction injured by logging. Pac. Northwest Forest and Range Exp. Station Research Note 196, 5 pp.

Boyce, J. S. 1929. Deterioration of wind-thrown timber on the Olympic Peninsula, Washington, U. S. Dept. Agriculture Tech. Bul. 104, 28 pp.

Buchanan, T. S. and G. H. Englerth. 1940. Decay and other volume losses in wind-thrown timber on the Olympic Peninsula, Washington, U. S. Dept. Agr. Tech. Bul. 733, 29 pp.

Childs, T.W. and E. Wright. 1956. Pruning and occurrence of heart rot in young Douglas-fir. Pac. Northwest Forest and Range Exp. Sta. Research Note 132, 5 pp.

Childs, T. W. and J. W. Clark. 1953. Decay of wind-thrown timber in western Wash. and northwestern Oregon. U. S. Dept. Agr. Forest Path. Spec. Release 40, 20 pp.

Engelhardt, N. T. 1961. Pathological deterioration of wind-damaged white spruce and alpine fir in the Crescent Spur Area of British Columbia. Forest Ento. and Path. Branch, Dept. of For., Ottawa, Canada. Studies in Forest Pathology XXIII, 20 pp.

Hunt, J. and K. W. Krueger. 1962. Decay associated with thinning wounds in young growth western hemlock and Douglas-fir. Journ. of For. 60:5, p. 336-340.

Shea, K. R. 1960. Fungus succession and the significance of environment in the deterioration of logs. Weyerhaeuser Co. Forestry Research Note 30, 7 pp.

Shea, K. R. 1960. Decay in logging scars in western hemlock and Sitka spruce. Weyerhaeuser Co. Forestry Research Note 25, 13 pp.

Shea, K. R. 1961. Deterioration resulting from logging injury in Douglas-fir and western hemlock. Weyerhaeuser Co. Forestry Research Note 36, 5 pp.

Shea, K. R. 1962. Deterioration of wind-thrown conifers three years after blowdown in southwestern Washington. Weyerhaeuser Co. Forestry Research Note 44, 17 pp.

Wright, E. and L. A. Isaac. 1956. Decay following logging injury to western hemlock, Sitka spruce and true firs. U. S. Dept. Agr. Tech. Bull. 1148, 33 pp.